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SPILOVERS OF THE ECB'S NON-STANDARD MONETARY POLICY INTO CESEE ECONOMIES

by Alessio Ciarlone* and Andrea Colabella*

Abstract

In this paper we provide evidence that the effects of the ECB's asset purchase programmes spill over into CESEE countries, contributing to easing their financial conditions both in the short and in the long term through different transmission channels. In the short term, a number of variables in CESEE financial markets appear to respond to news related to the ECB's non-standard policies by moving in the expected direction. Over a longer-term horizon, we found that cross-border portfolio and banking capital flows towards CESEE economies have been affected by both the announcement and the actual implementation of the ECB's asset purchase programmes, pointing to the existence of a portfolio rebalancing and a banking liquidity channel.

JEL Classification: C32, C33, E52, E58, F32, F36.

Keywords: unconventional monetary policy, ECB, Central and Eastern Europe, international spillovers, event study.

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1. Introduction

Since the onset of the 2008-2009 global financial crisis the European Central Bank (ECB), similarly to other central banks in advanced economies (AEs), has implemented a series of non-standard monetary measures to address a range of unusual risks, including disturbances to liquidity in certain financial asset markets, to dispel the fears of a euro break-up and ‘redenomination risk’ and, more recently, to tackle the serious consequences of a prolonged period of excessively low inflation. Among these non-standard measures, asset purchase programmes have increasingly gained importance, accounting for around 30% of total assets in the Eurosystem’s balance sheet as of late 2015.¹

While most of the existing research on the international spillover effects of unconventional monetary policies (UMP) has focused on the US Fed’s quantitative easing (QE) measures, the available evidence about the ECB’s non-standard policies is relatively scant so far. The aim of this paper is to fill this gap, by gauging the impact of the ECB’s asset purchase programmes on the financial markets of a set of Central, Eastern and South Eastern European (CESEE) economies,² which are integrated with the euro area through strong financial linkages. Indeed, the euro area is the source of large capital flows to the CESEE economies and their domestic banking systems are largely dominated by euro area banking groups. Against this background, there is a strong case for assessing the possible spillover effects on CESEE financial markets stemming from the ECB’s asset purchase programmes. Our expectation is that the ECB’s security purchases have had significant effects on CESEE financial markets, supporting both cross-border portfolio flows and banking flows.

To start with, using an event study methodology, we look at how nominal exchange rates (FX), long-term sovereign yields, stock market indices and portfolio inflows to CESEE economies responded in the very short term to the announcements related to the ECB’s asset purchase programmes. After controlling for global volatility developments and for macroeconomic surprises in major AEs, we find that the announcements triggered a broad-based appreciation of the nominal FX vis-à-vis the euro, an increase in domestic stock market indices and a moderate compression of long-term sovereign yields. These events also seem to be linked to larger portfolio capital flows, hinting at the existence, among other things, of a *portfolio rebalancing* transmission channel.

To check for more persistent financial spillover effects from the euro area, we then examine the impact of the ECB’s asset purchase programmes on the dynamics of cross-border capital flows, looking separately at both portfolio investment (*portfolio rebalancing* channel) and international bank lending (*banking liquidity* channel). For each of these two transmission mechanisms, we compute fixed-effect panel regressions on quarterly data to try to infer the influence of a number of variables intended to proxy for the effect of the ECB’s asset purchases programmes: a dummy variable for the announcement or impact effect of non-standard measures; a set of indicators for euro area liquidity and financial conditions to capture the likely effect of the actual implementation of such programmes of outright purchases of financial assets on secondary markets. In particular, the influence of this second set of indicators is evaluated both directly and indirectly, in the latter case by running a two-stage estimation procedure in order to isolate the changes in such indicators

¹ Throughout the paper we will refer indifferently to the ECB’s or the Eurosystem’s non-standard tools while such measures are actually decided and implemented by the Eurosystem as a whole.

² CESEE economies are made up of both non-euro area EU countries –Bulgaria, Croatia, the Czech Republic, Hungary, Poland and Romania – and EU candidates and potential candidates – Albania, Bosnia-Herzegovina, the FYR of Macedonia, Montenegro and Serbia.

due to the ECB's asset purchase programmes. Our results show that such non-standard monetary measures may have fostered both cross-border portfolio investment flows into and foreign bank claims on the CESEE economies.

The paper is structured as follows. After a brief overview of the main transmission channels of unconventional monetary policies and the related economic literature (Section 2), we provide a description of the different measures implemented by the ECB (Section 3). Section 4 presents the event study approach, while Section 5 illustrates our empirical strategy for detecting the longer-term financial spillover effects via the *portfolio rebalancing* channel (Section 5.2) and the *banking liquidity* channel (Section 5.3). Section 6 concludes the paper.

2. Main transmission channels and related literature

Since 2008-2009, the slashing of the official reference rates to the zero lower bound (ZLB) and the implementation of unconventional measures by major central banks in AEs have spurred the interest of researchers in analysing the impact of these policies on global financial markets. The vast majority of the empirical studies rely upon short-term event study techniques, with only a handful of papers devoted to the analysis of longer-term and more persistent spillover effects.

Within the general functioning of outright asset purchase programmes (Cova and Ferrero, 2015; Bluwstein and Canova, 2015), the literature has focused on three main channels that transmit their effects to the financial system and the broader economy, both domestically and internationally: the *portfolio rebalancing*, the *banking liquidity* and the *signalling* channels.

The outright purchase of public and private securities, by modifying the size and the composition of the balance sheet of both the central bank and the private sector, may affect the economy through the *portfolio rebalancing* channel. As these measures involve the purchase of longer-duration assets, they increase the liquidity holdings of sellers, inducing a rebalancing of investors' portfolios towards the preferred risk- return configuration. A necessary condition for this channel to be effective is an imperfect substitutability among different assets, i.e. assets are not perceived as perfect substitutes by investors, due to the presence of economic frictions (e.g. asymmetric information, limited commitment and limited participation; Cecioni *et al.*, 2010; Falagiarda and Reitz, 2015). By purchasing a particular security, the central bank reduces the amount of that security held by private agents, usually in exchange for risk-free reserves. As a result, asset prices increase and long-term interest rates fall, creating more favourable conditions for economic recovery.

Outright asset purchases may also directly ease financial conditions and support bank lending to the private sector by improving the availability of funds through a *banking liquidity* channel. The counterpart of the purchase of long-term assets on private banks' balance sheets is typically an increase in reserves. Since such reserves are more easily traded in secondary markets than long-term securities, there would be a decline in the liquidity premium which, in turn, would enable previously liquidity-constrained banks to extend credit to investors. This would result in a decline of borrowing costs and an increase in overall bank lending, including cross-border lending to emerging and developing countries (Lim *et al.*, 2014). The importance of this channel largely depends on the business cycle and on the conditions of the domestic banking sector.

The *signalling* channel operates when, through its unconventional measures, the central bank conveys information to the public about its intentions regarding the future evolution of short-term interest rates, the purchase of financial assets or the implementation of other measures to tackle

market dysfunctions. If this communication is perceived by market participants as a signal of lower-than-previously-expected future policy rates, long-term yields may decline (via a lower risk-neutral component in interest rates). This channel is linked to a sort of *confidence* channel whereby the announcements, or actual operations, of the central bank may contribute to reducing economic uncertainty, reducing risk premia and bolstering activity. In this case, the credibility of the central bank is a crucial factor.

The above classification, of course, makes no claim to being exhaustive.³ In practice, there is a substantial degree of overlapping among the different channels, as shown by the literature. For this reason, it is often impossible to identify unambiguously which channels may have been at play.

The extant literature on the topic has mainly focused on the US experience, documenting the global dimension of the Fed's QE programmes extensively. Chen *et al.* (2012) are the first to have provided empirical evidence about the international spillovers of the US's large scale asset purchase (LSAP) programmes. By means of event-study techniques, they examine the short-term impact of the announcements of such policies on the financial markets of some emerging economies (EMEs):⁴ their results are consistent with the view that the Fed's QE measures led to significant cross-border spillovers (to EMEs) by raising equity prices, lowering government and corporate bond yields and compressing CDS spreads;⁵ these effects, moreover, turned out to be greater than those prevailing in the US domestic markets. The existence and the extent of longer-term cross-country macro-financial linkages is then captured by means of a global vector error-correcting model, where unconventional monetary measures are modelled as a negative shock to the US term spread (Chen *et al.*, 2012), to the 'shadow' federal fund rate (Chen *et al.*, 2014) or to the corporate spread (Chen *et al.*, 2015), respectively. Overall, they show a sizeable and widespread impact on EM financial markets via, among other things, stock prices, bank credit and FX pressures.⁶

Moore *et al.* (2013) focus on both an international *portfolio rebalancing* channel and an *asset pricing* channel, by examining whether the Fed's LSAP programmes influenced capital flows from the US to EME local currency government bond markets, as well as the degree of the pass-through from long-term US to long-term EME local currency government bond yields. Based on a panel of 10 EMEs, for which data on foreign investment in government bonds are available, their estimates suggest that a 10bp reduction in long-term US Treasury yields triggers a 0.4pp increase in the foreign ownership share of government debt, with a reduction of government bond yields by approximately 1.7bp.

³ In the extant literature there is a very long series of transmission channels. To name but a few examples: Krishnamurthy and Vissing-Jorgensen (2012) proposed a *duration risk* channel, a *safety* channel, a *prepayment risk premium* channel, a *default risk* channel and an *inflation* channel; Fratzscher *et al.* (2014) added a *risk aversion* channel, a *bank credit risk* channel and a *sovereign credit risk* channel; Cova and Ferrero (2015) an *asset pricing* channel and a *government budget constraint* channel.

⁴ They estimate the effects of the announcement dates associated with the first rounds of the two Fed's *unconventional* measures: QE1 – which traditionally refers to the period immediately after the collapse of Lehman Brothers in September 2008 – and QE2 – which refers to the further push implemented by the Fed from the second half of 2010, primarily concentrated on purchases of US Treasury securities.

⁵ The authors link these results to the working of many different transmission channels : the role of the US term structure in setting a benchmark for global assets, a *confidence* channel reflecting perceptions of the strength of the global economy and an *endogenous monetary policy response* channel aimed at narrowing international policy rate differentials.

⁶ By applying factor analysis in order to disentangle a 'signal' (assumed to affect expectations of future short-term policy rates) from a 'market' factor (assumed to affect longer-term rates through a variety of channels) in the conduct of US monetary policy, the authors showed how spillovers have been different and stronger during the unconventional monetary phase (i.e. from November 2008 onwards) than previously.

In a traditional empirical model of ‘push and pull’ determinants of capital flows to Asia and Latin America, Ahmed and Zlate (2014) isolate changes in US Treasury yields that can be attributed to the Fed’s LSAP programmes and examine their effect on EME capital flows. Overall, their results point to the existence of a positive effect of the US UMP on total and portfolio inflows, which is greater for the gross (compared with net) component and for the portfolio (compared with total) category of flows. Nevertheless, the authors caution that unconventional US policies appear to be just one among several other important factors explaining changes in international capital flows to EMEs.

Similarly to Ahmed and Zlate (2014), Lim *et al.* (2014) develop a procedure to test the importance of three distinct transmission channels (i.e. a *liquidity*, a *portfolio rebalancing* and a *confidence* channel) for the Fed’s QE on gross financial flows (FDIs, portfolio flows and bank loans) in 60 developing countries.⁷ According to their analysis, observed capital inflows to EMEs are involved in all those three transmission channels; however, UMPs seem to have additional and largely unexplained effects different from those of the three channels;⁸ lastly, different types of inflows may respond differently, with portfolio (especially bond) flows more sensitive to the identified transmission channels, and bank loans to the unexplained component of QE and FDIs.

All the papers surveyed above refer to the effects of the US UMP. Research on the international spillover effects of the ECB’s non-standard monetary policy is relatively scant and again, generally based on short term event study techniques. Fratzscher *et al.* (2014) attempt to quantify the impact of the earliest measures – the Supplementary and the Very Long-Term Refinancing Operations (S- and V-LTROs) of March 2008 and December 2011, respectively; the Securities Market Programme (SMP) of May 2010 and the Outright Monetary Transactions (OMT) of September 2012 – on a number of transmission channels affecting both quantities (international portfolio flows into bond and equity markets) and asset prices (equity, FX, long-term yields, risk premia for global banks and sovereigns), both in the euro area and globally. They find that the ECB’s non-standard policies impacted positively on global equity markets and confidence, lowering credit risk among banks and sovereigns in both AEs and EMEs; however, the ECB’s measures seem to lead to an international *portfolio rebalancing* of a much more limited size in the short term than the Fed’s policies did.

Georgiadis and Gräb (2015) estimate the global impact of one of the latest ECB non-standard policies – i.e. the Expanded Asset Purchase Programme (EAPP), launched in January 2015 – on global equity prices, nominal exchange rates vis-à-vis the euro and bond yields. Their results show that the announcement of the launch of the EAPP brought about a global depreciation of the euro vis-à-vis its major trading partners, an increase in equity prices, but just a limited decline in global yields, probably reflecting already low levels. In testing for the existence of *portfolio rebalancing*, *signalling* and *confidence* channels, they find that the first two had some effects on eurozone equity prices, while eurozone sovereign bond yields seemed to have largely benefited from a confidence boost. This channel was also behind the rise in non-euro area equity prices, while the depreciation of the euro was mainly an effect of the *signalling* channel and, to a lesser extent, the *portfolio rebalancing* one. Finally, they find that domestic equities in different country aggregates except for the euro area only surged in response to the EAPP and OMT announcements, while the OMT and SMP ones led to a marked decline in intra-euro area sovereign bond yield spreads.

⁷ The *liquidity* channel is proxied by the 3-month Treasury bill rate; the *portfolio rebalancing* channel by the term spreads and the interest rate differential between developing countries and the US; the *confidence* channel by the VIX index.

⁸ According to their estimation results, of the 62% increase in overall gross inflows to EMEs observed between 2009 and 2013, at least 13% can be attributed to this additional QE effect.

Falagiarda *et al.* (2015) concentrate on the financial market effects in major non-euro area EU countries of Central and Eastern Europe (namely the Czech Republic, Hungary, Poland and Romania). They find evidence of strong spillover effects from the ECB's non-standard policies on these financial markets, especially on bond yields and the FX; moreover, the impact of the SMP announcements appears to be more marked than those from the OMT and PSPP announcements. Both the *portfolio rebalancing* and the *signalling* channels were at work following the SMP announcements, while the OMT operated mainly via the *confidence* channel; lastly, both the *confidence* and the *signalling* channel were significant in transmitting the effects of the PSPP announcement.

3. The ECB's asset purchase programmes

Since the first half of 2009, the ECB has implemented a number of asset purchase programmes as part of its non-standard monetary policy toolkit. The Enhanced Credit Support (ECS), adopted in May 2009 to expand the existing set of available non-standard monetary measures introduced in earlier phases,⁹ contained the first programme of outright asset purchases, i.e. the Covered Bond Purchase Programme (CBPP1), with the explicit goal of rekindling the functioning of the covered bond market, an essential source of refinancing for banks. This programme was further extended in November 2011 (CBPP2) and October 2014 (CBPP3).¹⁰

In May 2010, as tensions on the sovereign debt markets of some euro- area countries emerged, the ECB introduced an additional asset purchase programme, the Securities Market Programme (SMP) involving the purchases of euro- area government bonds to ensure adequate depth and liquidity in secondary markets. SMP purchases were made in two big waves, one in the first half of 2010 and the other in the second half of 2011, with their liquidity impact sterilized through specific operations. The purchases were conducted on a discretionary basis, according to daily market conditions.

The 'whatever it takes' speech by President Draghi in London in July 2012, at the height of the European sovereign debt crisis, paved the way for the adoption, in September 2012, of a further asset purchase programme, the Outright Monetary Transactions (OMT) initiative. Within this programme, the ECB could purchase an unlimited amount of sovereign bonds maturing in 1-3 years on request by a government asking for financial assistance, provided that the bond-issuing country implemented the specific measures (the conditionality principle) agreed under an adjustment programme to be signed with the ESFS (later the ESM). The declared objective of the OMT was to

⁹ In the earlier phases, non-standard monetary policy measures were directly targeting markets essential for commercial banks' funding, with the explicit aim of restoring proper liquidity conditions that had been impaired by the global financial crisis. Against a background of severe stress in the interbank markets due to solvency concerns, widespread financial uncertainty and liquidity hoarding by market participants, some of the measures introduced by the ECB were: a) unlimited provision of liquidity through 'fixed rate tenders with full allotment', allowing banks unlimited access to central bank liquidity at the main refinancing rate, subject to appropriate collateral; b) a broadening of the list of eligible collateral assets for refinancing operations; c) an extension of the maturity (to 6 months) of long-term refinancing operations (LTROs), to reduce uncertainty and improve liquidity conditions for banks; d) liquidity provision in foreign currencies through swap lines with other central banks.

¹⁰ The CBPP1 ended, as planned, on 30 June 2010 when it reached the originally announced target of €60 billion in nominal terms. The CBPP2 terminated on 31 October 2012 when it reached a nominal amount of €16.4 billion, below the original targeted amount of €40 billion. The CBPP3, on the contrary, was not launched with a pre-fixed targeted nominal amount; as a matter of fact, as of 13th May 2016, it reached €175.3 billion.

safeguard ‘(...) an appropriate monetary policy transmission and the singleness of the monetary policy (...)’ by lowering bond yields – whose high level was deemed to be unjustified if compared with the value implied by fundamentals (see for example, Di Cesare *et al.*, 2012) – especially at the long end of the curve, thus reducing borrowing costs and providing confidence to investors in the sovereign bond markets. The OMT should therefore be introduced to overcome monetary and financial fragmentation in the euro area by removing the redenomination risk related to a breakup of the euro area. It is worth recalling that the OMT has never been implemented.

In June 2014, the ECB announced the credit easing package, to support lending to the real economy through the following strategies: a) conducting a series of targeted longer-term refinancing operations (T-LTROs) aimed at improving bank lending to the euro area’s non-financial private sector, excluding loans to households for house purchase, over a window of two years and b) intensifying preparatory work related to outright purchases of asset-backed securities (ABSPP), which started in October 2014 in parallel with the launch of the third wave of the CBPP.

In January 2015, the Governing Council announced the Expanded Asset Purchase Programme (EAPP), which adds a purchase programme for public sector securities (PSPP) to the existing private sector asset purchase programmes (CBPP3 and ABSPP), in order to address the risk of an overly long period of low inflation. Under the EAPP, the ECB has expanded its purchases to include bonds issued by euro- area central governments, agencies and the European institutions, with combined monthly asset purchases to amount to €60 billion until September 2016 (subsequently moved to March 2017, with the ECB Governing Council’s decision of December 2015) or until the adjustment in the path of inflation is consistent with the objective of monetary policy (an inflation rate below, but close to, 2% over the medium term). More recently, in April 2016 the Governing Council announced a further expansion of the EAPP: the upper limit on the monthly asset purchases was raised to €80 billion; moreover, investment grade euro-denominated bonds issued by non-bank corporations established in the euro area have been included in the list of eligible assets for regular purchases.

Chart 1 shows the relative amounts purchased on a daily basis by the ECB since autumn 2009, as well as the cumulated stock of financial assets held for monetary policy purposes. **Chart 2** shows the evolution of the different components of the asset side of the Eurosystem’s balance sheet, namely the overall value of both the main and the longer-term refinancing operations, the securities purchased under the different programmes (i.e. the shaded areas representing, on the one hand, the CBPP1, CBPP2 and SMP and, on the other, the EAPP), as well as a further category of other assets. The overall share of securities purchased under all programmes as a share of the Eurosystem’s total assets increased steadily to 10% between 2009Q3 and 2010Q3, hovered around this level until the end of 2014 and then started increasing again following the launch of the EAPP purchase programme to reach 30% as of end-2015.

4. An event study analysis

As a first step, we replicate the event study approach contained in much of the empirical literature on the topic. The basic idea is that, as long as financial markets are informationally efficient, the impact of both conventional and unconventional monetary policy measures should

occur when they are disclosed, via changes in market expectations.¹¹ This is the reason why we concentrate on the announcement or impact effect of the ECB’s asset purchase programmes, where the first term refers to all sorts of communication (press conferences, press releases, speeches and so on). **Table 1** contains a detailed chronology of all the identified events related to the announcement (and further modifications and extensions) of the ECB’s non-standard measures implying the purchase of public and private financial assets on secondary markets: for each event, we report the day of the announcement, the type of measure as well as a brief description of the relative main individual features.

More specifically, we look at how nominal FX, long-term sovereign yields, stock market indices and portfolio inflows reacted over a one-week time window to the set of announcements related to the ECB’s asset purchase programmes. Our econometric procedure implies the estimate of the following panel model with country fixed-effects:

$$y_{i,t}^{(j)} = \alpha_i + \beta_1 APP_{EA,t} + \beta_2 F_t + \epsilon_{i,t}$$

$$j \in \{FX, Equities, Bonds, Capital\ flows\}$$

where i is the country index and the α_i ’s stand for the country fixed-effects.

The dependent variable $y_{i,t}$ is, alternatively: i) the one-week percentage change in a country’s currency bilateral FX *vis-à-vis* the euro in percentage points; ii) the one-week change in a country’s ten-year government bond yield in basis points; iii) the one-week return on a country’s major stock market index in percentage points; iv) the weekly amount of portfolio inflows into, respectively, a country’s bond and equity sectors (in billions of dollars). The latter data come from the database provided by Emerging Portfolio Fund Research (EPFR).¹²

The explanatory variable of interest is $APP_{EA,t}$, a dummy indicator equal to one when an important announcement related to asset purchase programmes is made and zero otherwise; in our case, the dummy indicator includes 18 positive occurrences from January 2009 to December 2015 (**Table 1**). The vector of control variables F_t includes: i) contemporaneous surprises related to the release of macroeconomic indicators in the euro area and the US;¹³ ii) contemporaneous (log) changes in global volatility indicators, proxied by the VIX index in the case of stock market returns and capital inflows, the MOVE index in case of changes in long-term bond yields and the JPMorgan

¹¹ Even after the initial announcement, there may still be surprises. For instance, when the EAPP program was announced on January 22, 2015, markets expected €500-700 billion of purchases, but the ECB announced more than €1 trillion; moreover, markets were also surprised by the open-ended character of the programme.

¹² EPFR collects and aggregates data on the investment activity of a large number of individual funds specialized in asset allocation towards the countries belonging to our sample (among others). In particular, we focus our attention on the share of individual funds originating in the European Union because they are more likely to be affected by the ECB’s decisions.

¹³ To measure economic surprises we rely on the Citigroup Economic Surprise Indices, which are commonly regarded as objective and quantitative measures of economic news. They are calculated as the normalized deviation of the actual data release from the market consensus prior to the release (actual releases vs. the Bloomberg survey median). A positive reading of the Economic Surprise Index suggests that economic releases have on balance been beating consensus. The indices are calculated daily in a rolling three-month window. The weights of economic indicators are derived from the relative high-frequency spot FX impacts of 1 standard deviation data surprises. The indices also employ a time decay function to replicate the limited memory of markets.

currency volatility index for FX changes. These volatility indicators are used to account for movements related to common shocks.¹⁴

The estimated coefficient of $APP_{EA,t}$ turns out to be statistically significant and with the expected sign in all the specifications (**Table 2**). More precisely, the announcements caused a broad-based appreciation of CESEE currencies vis-à-vis the euro, an increase in the value of domestic stock market indices and a moderate compression of their respective long-term sovereign yields. These findings seem to support the hypothesis (Falagiarda *et al.*, 2015) of a sort of international *portfolio rebalancing*, as shown by the positive impact on portfolio capital flows to CESEE economies in both the equity and debt compartments.

However, event study techniques can only provide a limited representation of the spillover effects from non-standard monetary measures, since they cannot capture longer-lasting financial effects or shed light on their subsequent transmission. It is therefore important to combine this approach with other methodologies, which take into account longer time spans and control for a wider set of macroeconomic and financial variables. This approach gives us the opportunity to analyse other important transmission channels, including the *banking liquidity* channel, which we suspect is more significant than the *portfolio rebalancing* one for CESEE economies in light of these countries' deep banking interlinkages with the euro area. To our knowledge, we are the first to tackle this issue.

5. Longer-term spillovers from the ECB's asset purchase programmes

In this section we examine whether, and to what extent, the implementation of the ECB's asset purchase programmes affected the (quarterly) flows of international portfolio investments and cross-border banking capital towards our sample of CESEE economies during the period from 2009Q3 to 2015Q4. This will allow us to detect the existence of both a *portfolio rebalancing* and a *banking liquidity* channel.

5.1 The empirical strategy

Our approach builds upon two strands of research. On the one hand, according to a large body of literature – which has grown around the seminal papers by Bruno and Shin (2012, 2013, 2014 and 2015) and Rey (2013, 2015) – global liquidity and funding conditions, often described as the 'ease of financing' and largely dependent on the very accommodative conventional and unconventional monetary policies implemented by AEs' central banks after the 2008-09 financial crisis, have contributed to a surge of cross-border international capital flows.¹⁵ On the other hand, Ahmed and Zlate (2014) and Korniyenko and Loukoianova (2015) show how to isolate, among the changes in global monetary and liquidity conditions, those directly attributable to the unfolding of the unconventional monetary measures implemented by AEs central banks. More specifically, this is done by substituting the available indicators of global liquidity conditions with some other instruments. We will apply this approach to the ECB's outright purchases of public and private

¹⁴ All our data have weekly frequencies: nominal FX, long-term sovereign yields, stock market indices and surprise indices are end-of-period data, recorded and reported on Fridays; portfolio inflows are released and recorded on Wednesdays, and refer to the seven days including the reporting day.

¹⁵ Although the assumption in the literature has been that factors driving global liquidity originate predominantly in the US, some recent results (Cerutti *et al.*, 2014; Korniyenko and Loukoianova, 2015) suggest that euro- area supply factors are both regionally and globally important too.

financial assets on secondary markets carried out between 2009Q3 and 2015Q4 and see how they translated into a gradual easing of financial and liquidity conditions in the euro area; these, in turn, impacted on the cross-border portfolio and banking flows towards CESEE economies.

Our set of measures of financial and liquidity conditions in the euro area comprises a standard array of price and non-price indicators, extensively used in the empirical literature on global liquidity: the average level of 10-year yields on euro area AAA rated government bonds (Korniyenko and Loukoianova, 2015); the yield curve slope, defined as the differential between 10-year and 3-month yields of AAA euro area government bonds (Cerutti *et al.*, 2014); the yearly changes in the M2 aggregate (IMF, 2010) and in the credit to the private sector aggregate (Cerutti *et al.*, 2014); the average spread between Italian and Spanish long-term yields and the German Bund (this variable should capture the redenomination risk related to the breakup of the euro area and the ensuing fragmentation of the euro area financial system).¹⁶ As documented by Albertazzi *et al.* (2012), Neri (2013) and Zoli (2013), at the height of the euro area sovereign debt crisis, movements in the Italian and other euro area sovereign spreads were adversely transmitted to bank funding costs, lending conditions and the availability of credit for the real economy.

Our interest is focused on the changes of these components within the more accommodative liquidity and financial conditions in the euro area, which can be accounted for by the actual implementation of the ECB's asset purchase programmes. To isolate these changes we follow a two-stage procedure proposed by Ahmed and Zlate (2014) and Korniyenko and Loukoianova (2015). In the first stage, we run a simple OLS regression over the period from 2009Q3 to 2015Q4, where we use the ECB's actual gross asset purchases as an explicit determinant of euro area liquidity and financial conditions indicators. The estimates show a significant relationship between the ECB's asset purchases, on the one hand, and the various indicators of financial and liquidity conditions in the euro area, on the other (**Table 3**). More precisely, the actual realization of these non-standard programmes has gone along with an acceleration in the growth of the M2 aggregate, the dynamics of credit to the private sector, a reduction in long-term government yields, a flattening of the yield curve and a compression in the sovereign spreads of peripheral euro area countries. In the second stage, we use the fitted values of the regressions in **Table 3** (less the respective estimated constants) as a proxy of the effect of the ECB's asset purchase programmes. **Chart 3** shows a graphical representation of both the actual liquidity indicators and the impact on them stemming from the ECB's non-standard measures.¹⁷

5.2 The portfolio rebalancing channel

While the empirical literature has extensively investigated the 'push and pull' drivers of private capital flows to EMEs, the number of studies looking specifically at the impact of AE monetary

¹⁶ According to Casiraghi *et al.* (2013), the asset purchases implemented under the SMP – which is a component of our sample of non-standard monetary measures – appear to have been effective in offsetting unjustified increases in government bond yields and easing money market tensions, with a positive and significant impact on credit supply. We tried two other indicators for the fragmentation of the banking sector: i) the euro area version of the 3-month LIBOR-OIS spread, a barometer of distress in money markets, which has served as a summary indicator showing the 'illiquidity waves' that severely impaired money markets in 2007 and 2008; ii) the average of 5-year CDS premia in Italy and Spain. However, econometric estimates with these variables (available upon request) do not show any significant results.

¹⁷ A principal component analysis among the whole series of financial and liquidity indicators showed that the first factor explains more than 70% of the total covariance. A successive OLS regression revealed that the ECB's gross asset purchases are a significant determinant for this first principal component.

policies is much more limited, in particular as regards those trying to isolate the impact of unconventional tools.¹⁸

In this section, we apply the procedure suggested by Ahmed and Zlate (2014) to check whether the ECB's asset purchase programmes might have influenced cross-border portfolio inflows to CESEE economies. Although the functional form is not derived from any structural model, we follow the basic tenets of the portfolio theory, according to which expected returns, risk and risk preferences matter for international investors' asset allocations. In order to quantify the specific influence of the ECB's asset purchase programmes, we augment the basic empirical model with some extra explanatory variables, such as the actual measures of liquidity and financial conditions in the euro area, as well as that part of them explained by the working of the outright asset purchases; alternatively, we may use a simple dummy variable to investigate the behaviour of such flows during the quarters when the different rounds of asset purchase programmes were first announced or subsequently extended.

The empirical model is the following:¹⁹

$$PORT_{i,t} = \alpha_i + \beta_1 G_i + \beta_2 G_{EA} + \beta_3 R_i + \beta_4 R_{EA} + \beta_5 VIX + \beta_6 LIQ_{EA} + \beta_7 t + \epsilon_{i,t}$$

where the international flows of portfolio investment to country i in period t , $PORT_{i,t}$, are supposed to be related to: i) growth in the two economies (G_i and G_{EA} , real GDP growth in country i and in the euro area, respectively); ii) the respective interest rates (R_i and R_{EA} , to capture the relative attractiveness of domestic versus foreign assets and thus capital flows); iii) the VIX index, as a measure of global risk aversion.²⁰ The term LIQ_{EA} comprises an array of non-price and price indicators of financial and liquidity conditions in the euro area – both the original series and those instrumented by the ECB's actual asset purchases – as well as the dummy indicator referred to above. As regards the expected sign of the relationship between the portfolio flows and the euro area financial and liquidity indicators, the extant literature points to a positive (negative)

¹⁸ Evidence on the latter topic can mostly be inferred from research on the effects of long-term US interest rates (or other proxies for global interest rates and liquidity conditions) during the pre-crisis period, while non-standard measures more recently used by AE central banks have rarely been included. Notable exceptions are represented by Moore *et al.* (2013) and Fratzscher *et al.* (2012, 2013, 2014).

¹⁹ **Appendix A** contains a detailed description of this model, highlighting how it could also be applied to identify a set of 'push' and 'pull' determinants of portfolio flows towards CESEE economies. Within this framework, we also estimated alternative model specifications, including those based on growth and interest rate differentials; none of them was able to beat the results obtained with the specification reported in the main text in terms of R-squared and the sign and significance of the coefficients. **Appendix C** contains a description of the main variables used for estimation purposes.

²⁰ The expected signs are as follows: i) as regards growth, we expect a positive β_1 , since a healthier economy is expected to attract larger inflows of capital, while the sign of β_2 is not unambiguously defined ex-ante, since stronger growth in the euro area might drive more capital abroad as well; ii) as regards interest rate conditions, β_3 and β_4 should have opposing signs, since higher interest rates in EMEs can attract capital inflows related, for instance, to carry-trade positions being undertaken or, by the same token, a decline in AEs interest rates would prompt investors to rebalance their portfolios toward higher-yielding assets, thus resulting in capital flows into EMEs; iii) β_5 should be negative, since a surge in volatility would prompt international investors to display typical 'risk-off' behaviour. It is also important to recollect that the VIX index, as well as other volatility indicators, has been used in the extant empirical literature as an explicit indicator for the unfolding of the 'signalling' and 'confidence' effect (Lim *et al.*, 2014); moreover, it has been shown how the ECB's non-standard policies have had a positive (i.e. decreasing) effect on this volatility indicator, as well as on other ones (Fratzscher *et al.*, 2014; Georgiadis and Gräb, 2015).

relationship with non-price (price) indicators (Cerutti *et al.*, 2014) and to a positive relationship with the dummy indicator (Ahmed and Zlate, 2014). Finally, a time trend t is included in all our specifications.

Our results are based on an unbalanced, quarterly panel dataset covering 11 CESEE economies over the period 2008Q1-2015Q4. To be consistent with the results obtained in the previous analysis, for the dependent variable we use data on portfolio investment flows by country of destination from the euro area based mutual funds compiled by EPFR. Monthly data from the provider are added up throughout each quarter; the four-quarter sum of portfolio inflows is then divided by the four-quarter sum of domestic GDP (expressed in USD) at current prices to eliminate seasonality. For the explanatory variables, the preferred measure of short-term interest rates is represented by the quarterly average level of 3-month interbank rates. While the VIX is available at much higher frequencies, we follow the literature in using the log of its quarterly average value, thereby capturing more persistent changes in market volatility. To guard against biases from simultaneity or reverse causality, lagged values of all the regressors are used in the estimation except the VIX, which is assumed to be exogenous.

Column (1) in **Table 4** shows the results of the model without liquidity indicators: overall, the estimated coefficients of the standard explanatory variables have the expected signs and are statistically significant.²¹ We then add to this basic representation, one by one, all the variables measuring the financial and liquidity conditions in the euro area, as well as their instrumented counterparts and the dummy indicator. We have chosen not to include all the latter indicators simultaneously, given the constraint represented by the relatively small size of the sample and the resulting limited degrees of freedom available for estimation purposes. Columns (2)-(5) of **Table 4** contain the results for the original series, Columns (6) those for the dummy indicator and Columns (7)-(9) those for the instrumented indicators.

The results point to a significantly positive influence on portfolio flows from euro area financial and liquidity conditions, confirming the results of the extant literature (IMF, 2010; Cerutti *et al.*, 2014). The coefficients of both M2 and private sector credit show the expected positive sign, the former being highly statistically significant. Similar conclusions hold for price indicators: a fall in euro area long term yields brings about larger portfolio flows to CESEE economies (as in Ahmed and Zlate, 2014); secondly, the negative sign for the coefficient of the yield curve slope would suggest that when euro area investment opportunities are more attractive, cross-border portfolio flows to CESEE countries decline (as in Cerutti *et al.*, 2014).

Turning to the effect of the announcement of the ECB's asset purchase programmes, the coefficient of the dummy has the expected sign and is statistically significant, thus confirming the results of the previous event study analysis. Once the indicators of the actual financial and liquidity conditions are supplanted by their corresponding instrumented variables, their respective coefficients have the expected sign and are also highly statistically significant.

²¹ Portfolio inflows towards CESEE economies appear to be positively related to stronger growth realizations both domestically and in the euro area, although the latter are not statistically significant. More relevant contributions to the explanation of the dynamics of portfolio flows stem from interest rate conditions, where the magnitudes of the estimated effects appear to be economically significant as well: a one percentage point increase in domestic short-term rates in the CESEE economies would be associated with additional portfolio inflows of 0.05% of GDP, while the same increase in euro area short-term rates would lead to a net outflow of 0.21% of GDP. Confirming the results in the literature, greater global risk aversion has a significantly negative effect on portfolio inflows towards CESEE economies, from both a statistical and an economic perspective.

Overall, these results support the conclusion that the ECB’s asset purchase programmes tend to positively affect portfolio flows into CESEE countries both directly (based on their announcement effect) and indirectly (through their influence on our chosen set of indicators of euro area financial and liquidity conditions).

5.3 The banking liquidity channel

In this section, we analyse another transmission channel through which the ECB’s non-standard monetary measures might spread out to CESEE economies, by easing liquidity conditions for euro area international banks and influencing their decisions to extend cross-border lending abroad.

As was the case for the *portfolio rebalancing* channel, we complement a standard model of cross-border bank capital flows (McGuire and Tarashev, 2008; Buch *et al.*, 2009; Hermann and Mihaljek, 2010; Garcia-Herrero and Martinez-Peria, 2005) – based upon a set of traditional control variables describing country-specific vulnerabilities and time-varying global financial conditions – with our set of variables measuring financial and liquidity conditions in the euro area, their instrumented counterparts, and the dummy indicator on the ECB’s asset purchase programmes announcements.²² Cross-border banking flows, $BANK_{i,t}$, will thus be explained by means of the following empirical model:

$$BANK_{i,t} = \alpha_i + \beta_1 G_i + \beta_2 R_i + \beta_3 NEER_i + \beta_4 M2_i + \beta_5 VIX + \beta_6 LIQ_{EA} + \epsilon_{i,t}$$

Given the constraint represented by the relatively small size of the sample, we start with a very simple specification, where international bank exposures from the BIS International Banking Statistics (IBS) are regressed on a set of domestic ‘pull’ factors, describing the main features of the receiving economy, and some measures of global conditions (countervailing ‘push’ determinants). More precisely, we assume that cross-border banking flows are positively related to: i) the real GDP growth rate, since faster growing economies may have greater demand for credit, including from abroad (Cerutti *et al.*, 2014; Bruno and Shin, 2015); ii) a measure of domestic interest rate conditions, since countries characterized by higher interest rates attract more capital from abroad *ceteris paribus* (Hoffmann and Mihaljek, 2010; Cerutti *et al.*, 2014; Bruno and Shin, 2015); iii) a measure of exchange rate conditions, since an appreciation in the local currency tends to translate into more capacity for local debtors to repay borrowing in foreign currency (Hoffmann and Mihaljek, 2010; Bruno and Shin, 2015); iv) the annual growth rate of the domestic money supply, a likely leading indicator of the health of the economy (Bruno and Shin, 2014); v) the VIX index, in view of the strong commonality between international credit and portfolio flows and their synchronization with fluctuations in the global degree of risk aversion and uncertainty (Rey, 2013; Rey, 2015; Bruno and Shin, 2015). Finally, a time trend t is included in all our specifications.

Our results are based on an unbalanced, quarterly panel data set covering the 11 CESEE economies over the period 2008Q1-2015Q4. To mitigate possible endogeneity effects, all independent variables are lagged by one quarter (except the VIX, assumed to be exogenous). For

²² **Appendix B** contains a detailed description of this model, highlighting how it could also be usefully employed to assess a battery of likely ‘push’ and ‘pull’ determinants of cross-border banking flows towards CESEE economies. **Appendix C** contains a description of the main variables used for estimation purposes.

the dependent variable, we use exchange rate-adjusted changes in the external exposures (loans, securities and other claims) of BIS reporting banks vis-à-vis both the banking and the non-banking sector in CESEE economies. As regards short-term interest rates, we again resorted to the 3-month interbank rates, which are more widely available for the countries in our sample. As regards the measure of exchange rate conditions, we use the nominal effective exchange rate.²³

Column (1) in **Table 5** shows the estimated coefficients of the basic model without liquidity indicators, which confirm our expectations about both the sign and the statistical and economic significance of the explanatory variables. Cross-border banking flows are a positive function of the growth of real GDP and the M2 aggregate, the appreciation of the domestic currency in nominal effective terms and the level of domestic interest rates (though this variable is not statistically significant). Finally, cross-border banking flows appear to be negatively related to international investors' degree of risk aversion.

We then add, one by one, all our variables of interest: the financial and liquidity conditions in the euro area, with the results reported in columns (2)-(6) of **Table 5**, the dummy indicator, in column (7) and the instrumented indicators, in columns (8)-(12), and the following conclusions stand out. Firstly, cross-border banking flows towards CESEE economies seem to be positively related, as expected, to the two measures of non-price liquidity conditions, i.e. euro area private sector credit and M2 dynamics. Secondly, the coefficient of the average spread of stressed peripheral euro area countries vis-à-vis the German Bund is negative and statistically significant, suggesting that fragmentation and redenomination risks have brought about a reduction in cross-border banking flows towards CESEE economies. The euro area yield curve slope comes in again with a negative coefficient, as in Cerutti *et al.* (2015), hinting that when euro area investment opportunities are more attractive, cross-border banking flows decline. Lastly, a fall in euro area long-term yields is estimated to bring about larger cross-border banking flows to CESEE economies. Turning to the announcement episodes captured by the dummy indicator, the related coefficient suggests a positive impact on banking flows, though it comes out as not being statistically significant. Finally, once all the indicators of actual liquidity and financial conditions in the euro area are supplanted by their instrumented counterparts, their respective coefficients have the expected sign and are all statistically significant at conventional levels.

All in all, the more accommodative financial and liquidity conditions in the euro area resulting from the actual implementation of the ECB's asset purchase programmes, along with the easing of the tensions on the sovereign spreads of peripheral euro area countries, seem to have had an overall positive effect on cross-border banking flows towards CESEE economies.

6. Conclusions

Consistently with the findings of the empirical literature on the international effects of the unconventional monetary measures adopted by central banks in AEs, we have shown that the ECB's asset purchase programmes announced and implemented over the past five years have had

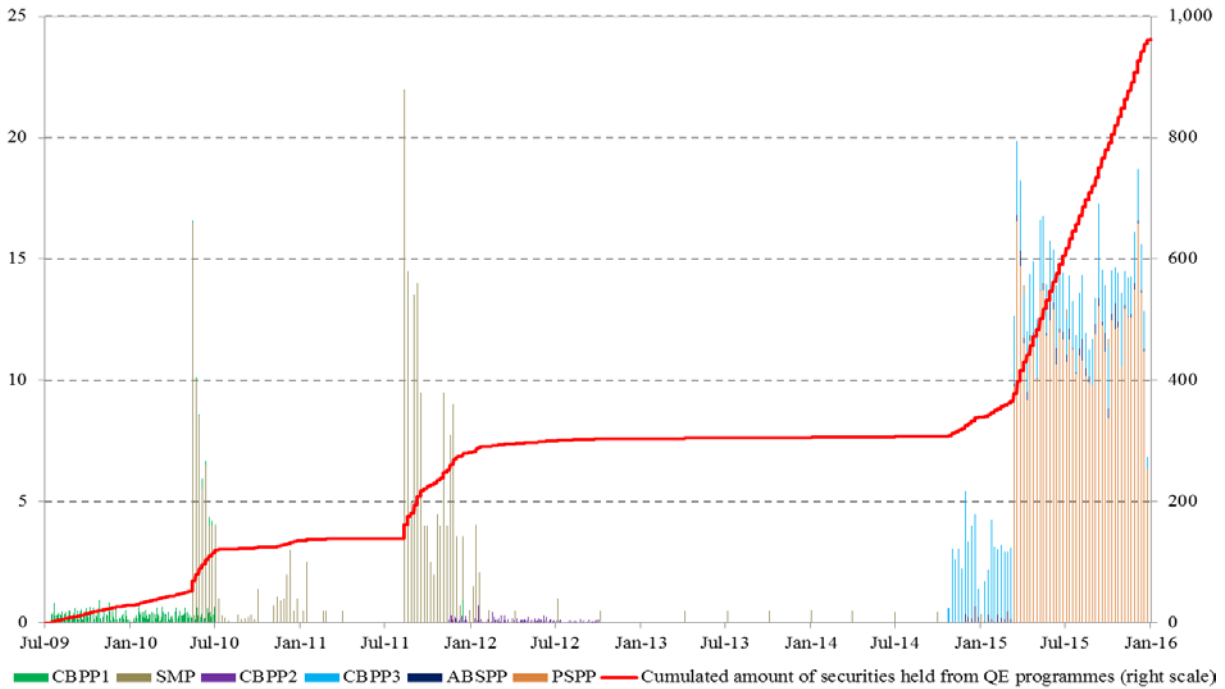
²³ Different types of reasoning lay behind this choice. First of all, we are taking into account cross-border flows from *all* BIS reporting banks: if, on the one hand, it is logical to expect that within this set, euro area headquartered banks play the most important role in flows to CESEE countries, on the other hand it is also true that they are not the only ones. This means that the use of a nominal FX rate vis-à-vis only the euro would have not been the best choice. Moreover, we are not estimating a gravity model as in Hermann and Mihaljek (2010) which, on the contrary, would have justified the use of all the bilateral FX rates of the borrower country j with respect to the currencies of all its lender countries i .

significant short and long term spillover effects on asset prices in and cross-border capital flows to eleven CESEE countries. As regards the short term effect, on the eighteen occasions where the ECB made some announcements on new or existing asset purchase programmes there was a statistically discernible impact on CESEE financial variables (e.g., weekly movements of the exchange rate vis-à-vis the euro, domestic stock market indices, long term sovereign yields, and also on weekly portfolio flows towards CESEE countries).

We have also extended our analysis to a longer time horizon through more articulated models of portfolio and international banking flows. Within these frameworks, we have found that both types of capital flows towards CESEE economies have been sustained by both the announcement and the actual implementation of the ECB's asset purchases programs. This evidence points to the existence of positive international spillover effects through both a *portfolio rebalancing* and a *banking liquidity* channel.

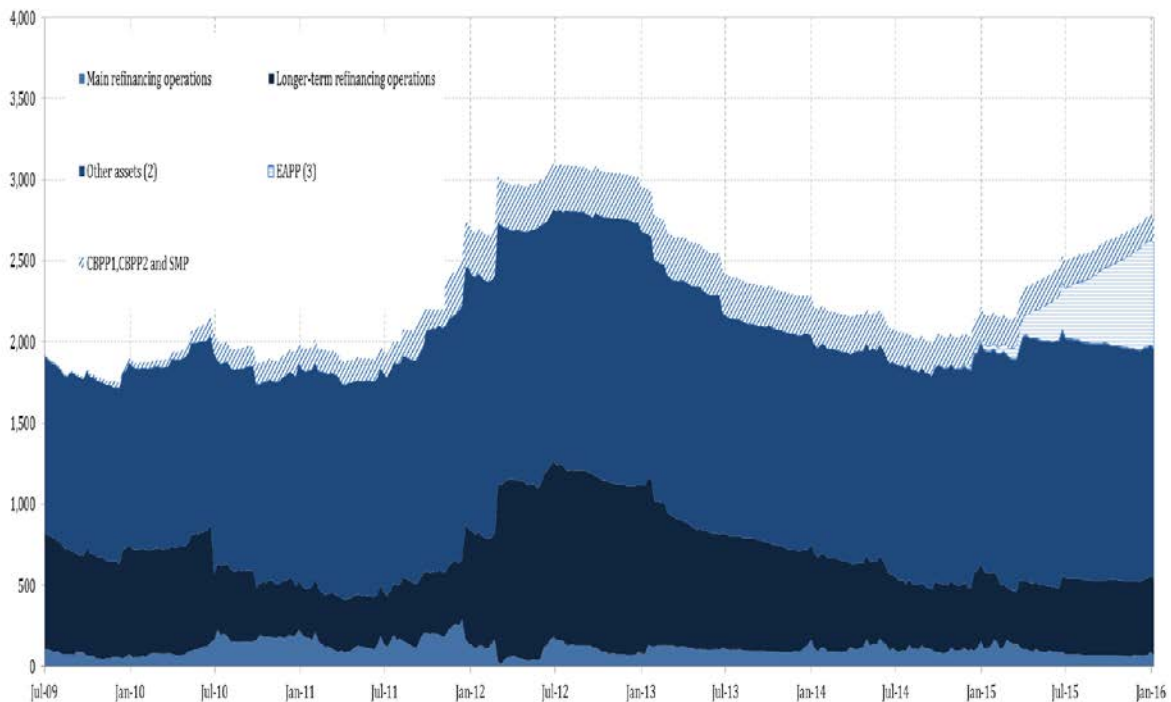
Charts and Tables

Chart 1. ECB asset purchases
(daily data, billions of euros)



Source: European Central Bank.

Chart 2. ECB balance sheet
(daily data, billions of euros)



Note: (1) Shaded areas represent the ECB's asset purchase programmes. (2) Marginal lending facility, gold and other assets denominated in euros and foreign currency. (3) Covered Bond Purchase Programme 3 (CBPP3), Asset-Backed Purchase Programme (ABSPP) and Public Sector Purchase Programme (PSPP).

Chart 3. Actual and instrumented euro area liquidity indicators

(quarterly data; % and billions of euros)

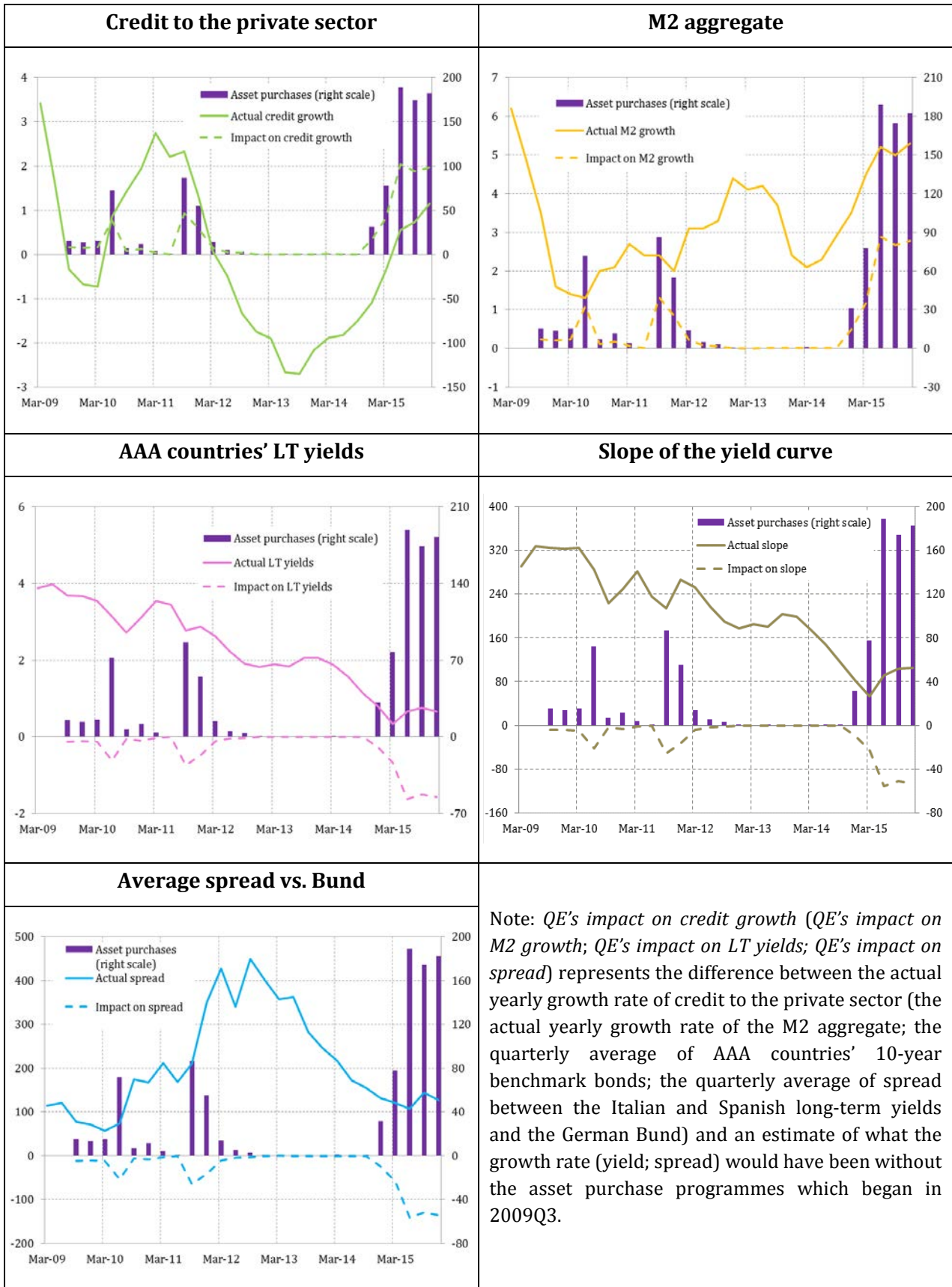


Table 1. The ECB's asset purchase programmes

Announcement date	Quarter	Non-standard monetary policy decision	Note
07-mag-09	2009Q2	A Covered Bond Purchase Programme (CBPP1) announced	"The Governing Council has decided in principle that the Eurosystem will purchase euro-denominated covered bonds issued in the euro area . The detailed modalities will be announced after the Governing Council meeting of 4 June 2009.
4-Jun-09	2009Q2	CBPP1 starts	"Following-up on its decision of 7 May 2009 to purchase euro-denominated covered bonds issued in the euro area, the Governing Council of the European Central Bank decided upon the technical modalities today."
10-May-10	2010Q2	Securities Market Programme (SMP) announced (plus the first 6-month LTRO and the reactivation of fixed-rate tender procedures with full allotment)	"The Governing Council of the European Central Bank decided on several measures to address the severe tensions in certain market segments which are hampering the monetary policy transmission mechanism and thereby the effective conduct of monetary policy oriented towards price stability in the medium term".
6-Oct-11	2011Q4	A new Covered Bond Purchase Programme (CBPP2) announced (plus one 12- and one 13-month LTROs)	"The Governing Council of the European Central Bank decided (...) to launch a second covered bond purchase programme (CBPP2) :"
3-Nov-11		CBPP2 starts	"Further to its decision of 6 October 2011 to launch a new covered bond purchase programme (CBPP2), the Governing Council of the European Central Bank decided today upon the technical modalities of the programme".
26-Jul-12	2012Q3	President Draghi's "whatever it takes" London speech	
2-Aug-12		Outright Monetary Transaction (OMT) announced	"The Governing Council (...) may undertake outright open market operations of a size adequate to reach its objective. (...) Furthermore, the Governing Council may consider undertaking further non-standard monetary policy measures according to what is required to repair monetary policy transmission".
6-Sep-12		Technical features of OMT	"As announced on 2 August 2012, the Governing Council of the European Central Bank has today taken decisions on a number of technical features regarding the Eurosystem's outright transactions in secondary sovereign bond markets that aim at safeguarding an appropriate monetary policy transmission and the singleness of the monetary policy".
5-Jun-14	2014Q2	Outright purchases of asset-backed securities announced (plus a series of targeted longer-term refinancing operations T-LTROs).	"In pursuing its price stability mandate, the Governing Council of the ECB has today announced measures to enhance the functioning of the monetary policy transmission mechanism by supporting lending to the real economy. In particular, the Governing Council has decided: (...) 2. To intensify preparatory work related to outright purchases of asset-backed securities (ABS) ".
4-Sep-14	2014Q3	ABS purchase programme (ABSPP) and a new Covered Bond Purchase Programme (CBPP3) announced	"(...) the Governing Council decided to start purchasing non-financial private sector assets . (...) The Eurosystem will purchase a broad portfolio of simple and transparent asset-backed securities (ABSs) (...) under an ABS purchase programme (ABSPP) . (...) In parallel, the Eurosystem will also purchase a broad portfolio of euro-denominated covered bonds issued by MFIs domiciled in the euro area under a new covered bond purchase programme (CBPP3) ".
2-Oct-14	2014Q4	Operational details of ABSPP and CBPP3	"The Governing Council of the European Central Bank today agreed key details regarding the operation of its new programmes to buy simple and transparent asset-backed securities (ABSs) and a broad portfolio of euro-denominated covered bonds. Together with the targeted longer-term refinancing operations, the purchase programmes will further enhance the transmission of monetary policy".

Table 1. The ECB's asset purchase programmes (cont.)

Announcement date	Quarter	Non-standard monetary policy decision	Note
17-Nov-14		President Draghi's testimony to the European Parliament set the stage for purchases of sovereign bonds	"If necessary to further address risks of too prolonged a period of low inflation, the Governing Council is unanimous in its commitment to using additional unconventional instruments within its mandate. (...) We have also tasked relevant ECB staff and Eurosystem committees with the timely preparation of further measures to be implemented, if needed. Such measures could include might entail the purchase of a variety of assets, one of which is sovereign bonds ".
26-Nov-14		Vice President Constancio's speech in London confirms this intention	"(...) we will have to consider buying other assets, including sovereign bonds in the secondary market ".
4-Dec-14		President Draghi's introductory statement to the press conference fully endorse the purchase of sovereign bonds	"Evidently we are convinced that a QE programme which could include sovereign bonds falls within our mandate , or better, is an eligible instrument that we could use in the pursuit of our mandate. Not to pursue our mandate would be illegal".
22-Jan-15	2015Q1	Expanded Asset Purchase Programme (EAPP) - comprising the ABSPP, the CBPP3 and a new Public Sector Purchase Programme (PSPP) - announced	"The Governing Council of the European Central Bank today announced an expanded asset purchase programme . (...) this programme will see the ECB add the purchase of sovereign bonds to its existing private sector asset purchase programmes in order to address the risks of a too prolonged period of low inflation". Combined monthly asset purchases will amount to €60 billion and are intended to be carried out until at least September 2016 .
9-Nov-15	2015Q4	Increase in PSPP issue share limit announced	Increase in PSPP issue share limit (from 25 to 33%) enlarges purchasable universe of sovereign assets.
4-Dec-15		Reassessment of the appropriateness of the ECB's monetary policy stance	"The Governing Council decided to extend the asset purchase programme (APP) and carry out monthly purchases of €60 billion until the end of March 2017, or beyond, if necessary . (...) The Governing Council decided to include , in the public sector purchase programme, euro-denominated marketable debt instruments issued by regional and local governments located in the euro area in the list of assets that are eligible for regular purchases".
10-Mar-16	2016Q1	Reassessment of the appropriateness of the ECB's monetary policy stance	"At today's meeting the Governing Council of the ECB took the following monetary policy decisions: (...) (4) The monthly purchases under the asset purchase programme will be expanded to €80 billion starting in April . (5) Investment grade euro-denominated bonds issued by non-bank corporations established in the euro area will be included in the list of assets that are eligible for regular purchases.

Table 2. Event study analysis

	Nominal spot FX	10 year yields	Equity returns	Capital flows		
				All	Stock	Bond
ECB indicator dummy	0.147 (0.079)**	-0.034 (0.011)**	0.674 (0.303)***	1.853 (0.831)**	0.438 (0.224)*	1.520 (0.671)**
Surprise index (Citi)						
US	0.000 (0.000)*	0.000 (0.000)**	0.007 (0.001)***	0.007 (0.006)	0.014 (0.007)*	-0.004 (0.002)**
Euro area	0.001 (0.000)***	0.000 (0.000)**	0.002 (0.001)**	0.022 (0.015)	0.015 (0.008)*	0.010 (0.009)
Volatility measures						
JPMorgan	-0.028 (0.013)**					
MOVE		0.002 (0.001)**				
VIX			-0.052 (0.013)***	-0.069 (0.028)**	-0.023 (0.009)**	-0.052 (0.022)**
Constant	-0.036 (0.007)***	-0.008 (0.001)***	0.026 (0.020)	0.770 (0.119)***	-1.132 (0.055)***	1.692 (0.072)***
Observations	3,610	1,984	3,536	3,000	2,398	2,978
R-squared (adj.)	0.05	0.01	0.05	0.00	0.02	0.00

Note: the sample of 11 EMEs includes Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Hungary, FYR of Macedonia, Montenegro, Poland, Romania and Serbia. Robust standard errors are provided in parenthesis, ***p<0.01, **p<0.05, *p<0.1. **Nominal spot FX** is the (one-week) percentage change in country *i*'s currency bilateral exchange rate vis-à-vis the euro; **10 year yields** is the (one-week) change in country *i*'s ten-year government bond yield; **Equity return** is the (one-week) change in country *i*'s major stock market index; **Capital flows** are weekly amount of portfolio inflows into country *i*'s bond and equity sectors; the **Surprise index (Citi)** measures the contemporaneous surprises related to the release of macroeconomic indicators in the **US** and the **Euro area**; **JPMorgan** is a volatility index for EMEs FX changes; **MOVE** is a volatility index for long-term bond yields; **VIX** is the Chicago Board Option Volatility Index, a popular measure of the implied volatility of S&P 500 index options.

Table 3. The ECB's asset purchases and euro area financial and liquidity conditions

	Nominal credit (percentage)	M2 aggregate (percentage)	Long-term yields (in percent)	Slope of the yield curve (in basis points)	Average spread (in basis points)
Asset purchases	0.011 (0.004)***	0.015 (0.002)***	-0.009 (0.002)***	-0.587 (0.129)***	-0.745 (0.200)***
Costant	-0.633 (0.385)*	2.847 (0.220)***	2.500 (0.207)***	221.860 (15.470)***	243.234 (27.541)***
Observations	26	26	26	26	26
R-squared (adj.)	0.15	0.40	0.21	0.20	0.14

Note: robust standard errors are provided in parenthesis, ***p<0.01, **p<0.05, *p<0.1. **Nominal credit** is the yearly change in credit to the private sector; **M2 aggregate** is the yearly change in M2; **Long-term yields** is the average level of 10-year yields on euro area AAA rated government bonds; **Slope of the yield curve** is defined as the differential between 10-year and 3-month yields of euro area government bonds; **Average spread** is the average spread between Italian and Spanish 10-year yields and the corresponding German Bund.

Table 4. The *portfolio rebalancing* channel

CATEGORY	NAME OF VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Constant	0.482 (0.135)***	0.480 (0.189)***	0.258 (0.144)*	1.613 (0.616)***	0.891 (0.352)***	0.524 (0.199)**	0.676 (0.256)***	0.676 (0.252)***	0.676 (0.252)***	0.676 (0.249)***
Growth											
	Domestic real GDP growth	0.018 (0.009)*	0.018 (0.011)*	0.017 (0.010)*	0.020 (0.009)**	0.018 (0.010)*	0.019 (0.011)*	0.000 (0.022)	0.000 (0.022)	0.000 (0.020)	0.000 (0.021)
	Euro area real GDP growth	0.033 (0.019)	0.032 (0.023)	0.054 (0.027)**	0.035 (0.021)*	0.033 (0.021)	0.033 (0.022)	0.036 (0.032)	0.036 (0.033)	0.036 (0.030)	0.036 (0.030)
Short-term rates											
	Domestic interbank rate	0.052 (0.027)*	0.052 (0.029)*	0.053 (0.029)*	0.051 (0.028)*	0.057 (0.033)*	0.052 (0.028)*	0.042 (0.043)	0.042 (0.044)	0.042 (0.042)	0.042 (0.040)
	Euro area interbank rate	-0.201 (0.071)**	-0.209 (0.069)***	-0.307 (0.095)***	-0.206 (0.062)***	-0.310 (0.101)***	-0.202 (0.062)***	-0.282 (0.107)***	-0.282 (0.109)***	-0.282 (0.102)***	-0.282 (0.100)***
VIX		-0.095 (0.065)***	-0.093 (0.039)**	-0.012 (0.029)	-0.058 (0.048)	-0.041 (0.036)	-0.106 (0.044)***	-0.096 (0.030)*	-0.096 (0.030)***	-0.096 (0.028)***	-0.096 (0.029)***
Time trend		-0.012 (0.005)*	-0.012 (0.005)***	-0.018 (0.006)***	-0.045 (0.016)***	-0.024 (0.009)***	-0.014 (0.005)***	-0.017 (0.007)**	-0.017 (0.007)***	-0.017 (0.007)***	-0.017 (0.007)***
Euro area liquidity indicators											
	<i>Non-prices:</i>										
	Growth of Euro area credit		0.004 (0.010)								
	Growth of Euro area M2			0.045 (0.019)***							
	<i>Prices:</i>										
	Long-term bond yields				-0.261 (0.094)***						
	Slope of the yield curve					-0.001 (0.001)***					
Asset purchases							0.061 (0.020)***				
	Announcements										
Asset purchases' impact on:											
	Growth of Euro area credit							0.060 (0.029)**			
	Growth of Euro area M2								0.034 (0.016)**		
	Long-term bond yields									-0.052 (0.022)**	
	Slope of the yield curve										-0.001 (0.000)**
	Observations	201	201	201	201	201	201	168	168	168	168
	R-squared (adj.)	0.27	0.24	0.27	0.24	0.25	0.25	0.08	0.08	0.08	0.08

Note: the sample of 11 EMEs includes Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Hungary, FYR of Macedonia, Montenegro, Poland, Romania and Serbia. Bootstrapped (1,000 replications) standard errors are provided in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Table 5. The *banking liquidity* channel

CATEGORY	NAME OF VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Constant	7.841	7.070	6.514	15.879	16.905	10.078	4.502	10.588	10.588	10.588	10.588	10.588
		(3.887)*	(3.197)*	(3.407)*	(5.906)**	(4.410)***	(4.009)**	(4.387)	(3.608)**	(3.608)**	(3.608)**	(3.608)**	(3.608)**
Domestic													
	Domestic real GDP growth	0.583	0.136	0.389	0.579	0.168	0.554	0.577	0.170	0.170	0.170	0.170	0.170
		(0.153)***	(0.210)	(0.183)*	(0.143)***	(0.230)	(0.130)***	(0.154)***	(0.130)	(0.130)	(0.130)	(0.130)	(0.130)
	Domestic interbank rate	0.309	0.198	-0.037	0.355	0.158	0.478	0.260	-0.206	-0.206	-0.206	-0.206	-0.206
		(0.415)	(0.340)	(0.457)	(0.391)	(0.345)	(0.369)	(0.421)	(0.330)	(0.330)	(0.330)	(0.330)	(0.330)
	Exchange rate	0.209	0.176	0.168	0.251	0.127	0.156	0.229	0.158	0.158	0.158	0.158	0.158
		(0.071)***	(0.073)**	(0.088)*	(0.074)***	(0.090)	(0.076)*	(0.071)**	(0.087)*	(0.087)*	(0.087)*	(0.087)*	(0.087)*
	M2 growth	0.170	0.105	0.045	0.155	0.054	0.141	0.177	-0.063	-0.063	-0.063	-0.063	-0.063
		(0.057)***	(0.033)**	(0.033)	(0.053)***	(0.027)*	(0.051)**	(0.058)**	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Global													
	VIX	-2.089	-3.501	-2.339	-1.545	-2.286	-2.888	-1.018	-2.632	-2.632	-2.632	-2.632	-2.632
		(1.016)*	(0.552)***	(0.887)**	(1.123)	(0.811)**	(0.841)***	(1.278)	(0.834)**	(0.834)**	(0.834)**	(0.834)**	(0.834)**
Time trend													
		-0.256	0.021	-0.208	-0.479	-0.290	-0.130	-0.261	-0.182	-0.182	-0.182	-0.182	-0.182
		(0.133)*	(0.060)	(0.107)*	(0.214)*	(0.113)**	(0.107)	(0.132)*	(0.054)***	(0.054)***	(0.054)***	(0.054)***	(0.054)***
Euro area liquidity indicators													
<i>Non-price:</i>			1.035										
	Growth of Euro area credit		(0.296)***										
	Growth of Euro area M2			0.875									
				(0.371)**									
<i>Price:</i>					-2.012								
	Long-term bond yields				(0.840)**								
	Slope of the yield curve					-0.028							
						(0.010)**							
	Average spread						-0.015						
							(0.005)**						
Asset purchases													
	Announcements							0.011					
								(0.318)					
Asset purchases' impact on:													
	Growth of Euro area credit								2.839				
									(0.573)***				
	Growth of Euro area M2									1.294			
										(0.261)***			
	Long-term bond yields										-1.975		
											(0.399)***		
	Slope of the yield curve											-0.024	
												(0.005)***	
	Fragmentation/Redenom. risk												-0.020
													(0.004)***
	Observations	237	237	237	237	237	237	237	180	180	180	180	180
	R-squared (adj.)	0.55	0.63	0.64	0.56	0.66	0.62	0.55	0.15	0.15	0.15	0.15	0.15

Note: the sample of 11 EMEs includes Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Hungary, FYR of Macedonia, Montenegro, Poland, Romania and Serbia. Robust standard errors are provided in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

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Appendix A. Determinants of cross-border portfolio flows to CESEE economies

In modelling portfolio capital inflows to CESEE economies, we use the approach suggested by Ahmed and Zlate (2014) and start by considering determinants that could directly alter the differences between expected returns of investment in these economies versus those in the euro area.

In our empirical procedure, therefore, return differentials are assumed to be related, first to the growth performances of the two neighbouring areas: G_i and G_{EA} indicate real GDP growth in country i and in the euro area, respectively, the logic underlying this choice being the need to capture differences in expected returns due to diverging growth prospects.

Interest rate conditions also need to be taken into account properly when modelling any investment return outlook: R_i and R_{EA} indicate a measure of short-term interest rates in country i and the euro area, respectively, and are intended to capture the relative attractiveness of domestic versus foreign assets and thus capital flows. When AEs ease monetary policy, their interest rates decline, prompting investors to rebalance their portfolios toward higher-yielding assets, thus resulting in capital flows into EMEs; by the same token, higher interest rates in the latter economies can attract capital inflows related, for instance, to carry-trade positions being undertaken. Since in our sample only a handful of countries have an independent inflation-targeting regime in place,¹ we innovate from Ahmed and Zlate's approach in that we complement their evidence based on policy rates with that based on 3-month interbank rates, which are more widely available. We also depart from their methodology in another important respect: instead of constraining the coefficients of the previous variables to be essentially the same – which is the case when the growth rate or interest rate differentials are explicitly taken into account – we thought it could be more useful and insightful to simply cast them freely in the model estimation. Finally, given the downward trend in net private inflows in the post-crisis period, to guard against spurious results that may arise if some of the right-hand side variables are also trending, we include a time trend in all our specifications. According to these indications, our initial empirical representation assumes the following form:

$$PORT_{i,t} = \alpha_i + \beta_1 G_i + \beta_2 G_{EA} + \beta_3 R_i + \beta_4 R_{EA} + \beta_5 t + \epsilon_{i,t}$$

Our core results are based on an unbalanced, quarterly panel data set covering the 11 economies in the CESEE region over the period 2008Q1-2015Q4. For the dependent variable, to be coherent with the results obtained in the event study analysis, we again use data on portfolio investment flows by country of destination compiled by Emerging Portfolio Fund Research (EPFR), which aggregates data on the activity of a large number of individual funds specializing in emerging economies.² Monthly data series from the provider are summed up through each quarter; the four-quarter sum of portfolio inflows are then divided by the four-quarter sum of domestic GDP at current prices to control for seasonality.

Table A.1 shows the estimation results of our basic model of portfolio inflows. Specifications (1) and (2) are obtained by using the 3-month interbank rate series as the preferred measure of short-term interest rate conditions in CESEE economies and the euro area, both independently

¹ These countries are Albania, Hungary, Poland, Romania and Serbia. On the contrary, the Czech Republic, Bosnia, Bulgaria, Croatia and the FYR of Macedonia have an explicit or implicit exchange rate target, while Montenegro has opted for an unofficial euroization.

² EPFR data on portfolio flows can be assimilated to gross flows from a balance of payments point of view.

from each other (Model 1) or constrained to have the same coefficient (Model 2); specifications (3) and (4), however, replicate the same exercise by means of the policy rates, as in Ahmed and Zlate (2014).

By comparing the values reported in the first four columns, it is evident that Model 1 leads to the best explanation of the phenomenon being studied: overall, the explanatory variables come in with the expected sign and are statistically significant. Portfolio inflows towards CESEE economies appear to be positively related to stronger growth realizations both domestically and in the euro area, although the latter turns out not to be statistically significant at any conventional level. More relevant contributions to the explanation of the dynamics of portfolio inflows stem from interest rate conditions, where the magnitudes of the estimated effects appear to be economically significant as well: a one percentage point increase in short-term domestic rates in the CESEE economies would be associated with additional portfolio inflows of 0.05% of GDP, while the same increase in short-term euro area rates would lead to a capital outflow of 0.21% of GDP.³ As a reflection of these developments, Model 1 offers the highest adjusted R^2 , and will represent our preferred specification going forward.

We added some other macro variables to this very basic representation that have been suggested by the literature as important ‘pull’ drivers of capital inflows.

First, they may capture EMEs own vulnerabilities, of both an external (i.e. the current account to GDP, the stock of international reserves to M2 and the stock of short-term external debt to international reserves) and a domestic (the government balance to GDP) nature. Second, they may hint at the existence of capital controls/capital account restrictions which, by acting as a tax on returns, can indirectly influence the effective returns to CESEE vs. euro area assets: we assess their impact through a de facto degree of financial openness, calculated as the ratio of the sum of assets and liabilities from the international investment position to domestic GDP. Third, they may gauge the degree of development of domestic financial markets, where we evaluate their role by means of three different variables: an indicator of financial market development belonging to the Global Competitiveness Report published by the World Economic Forum, the ratio of the stock of credit to the private sector to GDP – a classic measure of financial deepening – and the ratio of stock market capitalization to GDP.

Overall, notwithstanding differing levels of significance, these variables mostly come in with the expected signs. Portfolio inflows, therefore, seem to be: i) negatively related to the presence of large external and domestic vulnerabilities, with the coefficient of the international reserves-to-M2 ratio – where large precautionary holdings of foreign exchange reserves are supposed to provide self-insurance against external payment shocks – coming in as statistically significant; ii) positively related to the degree of openness of financial accounts; iii) positively related to the degree of development of domestic financial markets, with the coefficient of the credit-to-GDP ratio coming in as statistically significant. We have to acknowledge, nevertheless, that the presence of these factors, where significant, only adds a modest improvement in terms of adjusted- R^2 , indicating that a significant portion of the variation in portfolio inflows remains unexplained by the included variables.

In the very last column (Model 5) we finally introduce the VIX as a measure of global risk aversion: against the background of the results put forward by the recent empirical literature

³ The magnitude of these effects should be correctly evaluated from the point of view that the portfolio inflows to the CESEE economies as reported by EPFR stand at 0.02% of domestic GDP in our sample, when averaged through both countries and quarters.

(Miranda-Agrippino and Rey, 2012; Rey, 2013; Rey, 2015) – according to which the global financial cycle co-moves negatively with this important proxy of international investors’ attitude towards risk – we expect to see the same relationship in our case as well. While the VIX is available at much higher frequencies, following the related literature we use the log of its average value observed over the quarter, thereby capturing more persistent changes in market volatility; assuming it to be exogenous, current (log) values are used in the regressions. Confirming the results of the extant literature, greater global risk aversion, measured as an increase in VIX, has a significantly (from both a statistical and economic perspective) negative effect on portfolio inflows towards CESEE economies.

Table A.1 The portfolio rebalancing channel: basic model and role of local and global factors

CATEGORY	NAME OF VARIABLE	(1)	(2)	(3)	(4)	(1.a)	(1.b)	(1.c)	(1.d)	(1.e)	(1.f)	(1.g)	(1.h)	(5)
Growth														
	Domestic real GDP growth	0.018 (0.009)*		0.010 (0.021)		0.017 (0.010)	0.013 (0.012)	0.012 (0.012)	0.016 (0.010)	0.021 (0.010)*	0.018 (0.009)*	0.032 (0.012)*	0.028 (0.014)*	0.018 (0.009)*
	Euro area real GDP growth	0.034 (0.019)		0.026 (0.030)		0.037 (0.019)*	0.031 (0.020)	0.041 (0.026)	0.042 (0.024)	0.023 (0.015)	0.034 (0.019)	0.053 (0.038)	0.021 (0.022)	0.033 (0.019)
	GDP growth differential		-0.020 (0.010)*		-0.020 (0.013)									
Short-term rates														
	Domestic interbank rate	0.051 (0.026)*				0.047 (0.027)*	0.041 (0.020)*	0.062 (0.031)*	0.065 (0.027)*	0.044 (0.021)*	0.051 (0.028)*	0.091 (0.057)	0.056 (0.035)*	0.052 (0.027)*
	Euro area interbank rate	-0.212 (0.073)**				-0.219 (0.073)**	-0.185 (0.052)**	-0.202 (0.060)**	-0.248 (0.091)**	-0.182 (0.054)**	-0.212 (0.073)**	-0.337 (0.118)**	-0.249 (0.066)**	-0.201 (0.071)**
	Interbank rate differential		0.000 (0.000)*											
	Domestic policy rate			0.055 (0.042)										
	Euro area policy rate			-0.253 (0.106)**										
	Policy rate differential				0.000 (0.000)									
VIX														
														-0.095 (0.065)**
Time trend														
		-0.011 (0.005)**	0.010 (0.004)**	-0.014 (0.006)**	0.008 (0.004)	-0.010 (0.005)*	-0.010 (0.005)*	-0.014 (0.006)*	-0.013 (0.007)*	-0.010 (0.004)**	-0.011 (0.005)*	-0.028 (0.008)**	-0.012 (0.008)*	-0.012 (0.005)*
Constant														
		0.189 (0.076)**	-0.244 (0.120)*	0.250 (0.194)	-0.205 (0.142)	0.177 (0.081)*	-0.142 (0.122)	0.468 (0.213)*	0.229 (0.141)	-0.565 (0.226)**	0.209 (0.355)	-0.398 (0.467)	0.076 (0.293)	0.482 (0.135)**
Other controls														
	Current account to GDP					-0.007 (0.006)								
	Reserves to M2						0.009 (0.003)**							
	Short-term external debt to reserves							-0.005 (0.003)						
	Government balance to GDP								0.017 (0.018)					
	<i>De facto</i> degree of financial openness									0.003 (0.001)**				
	Financial market development										-0.005 (0.089)			
	Credit to GDP											0.016 (0.007)**		
	Stock market capitalization to GDP												0.009 (0.008)	
	Observations	201	201	145	145	201	201	201	184	200	201	201	174	201
	R-squared (adj.)	0.27	0.09	0.18	0.06	0.27	0.29	0.29	0.29	0.31	0.26	0.27	0.30	0.27

Note: the sample of 11 EMEs includes Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Hungary, FYR of Macedonia, Montenegro, Poland, Romania and Serbia. Bootstrapped (1,000 replications) standard errors are provided in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Appendix B. Determinants of cross-border banking flows to CESEE economies

Understanding the determinants of cross-border bank flows is important per se for a number of reasons. First of all it gives us the opportunity to understand how crisis episodes may be transmitted internationally, and why different EMEs may be affected differently by the same negative event; moreover, it helps us to appreciate the financial stability implications for AEs stemming from negative feedback loops of financial crises in EMEs, which is especially true for euro area banks which have accumulated significant exposures to CESEE economies. Finally, it can also contribute to shedding some light on the structure of cross-border banking groups (i.e. whether they use a centralized treasury funding scheme rather than only funding each subsidiary with resources raised in the host country).

To answer these important questions, we use data on bank exposures (i.e. loans, securities and other claims) from the BIS International Banking Statistics (IBS), which provide a comprehensive picture of cross-border banking linkages across countries. The BIS IBS comprises two datasets, the locational and the consolidated statistics: by capturing the exposures of the most important banking systems to their foreign borrowers, their main purpose is to provide information on the role of internationally active banks in intermediating cross-border capital flows. Locational data are more important for countries receiving external loans, because the way they measure lending flows is consistent with the balance of payments statistics; this allows for better matching of cross-border bank flows and various macroeconomic and financial system characteristics in EMEs. On the contrary, consolidated data are more important for countries providing external loans, because they help assess the size of international banks' country and liquidity risk exposures.

Our analysis is based on the BIS locational data: their key organizational criteria are the country of residence of the reporting banks and their counterparties – i.e. they include data on gross international financial claims and liabilities of banks resident in a given country on the banking and non-banking sectors in other economies (hence the term 'cross-border') – as well as the recording of all positions on a gross basis, including those vis-à-vis own affiliates. This makes the locational statistics appropriate for measuring the role of banks in the intermediation of international lending flows.¹ Furthermore, BIS locational data provide not only a sectorial breakdown of lending to banks and non-bank entities but also, and more importantly, exchange rate-adjusted flows, which allows us to better perform a time series analysis of cross-border bank capital since they capture changes in the actual underlying positions of bank claims rather than variations in bank claims also due to unexpected FX movements. The exchange rate-adjusted changes in the external position of BIS reporting banks vis-à-vis both the banking and non-banking sectors in CESEE economies will therefore represent our main dependent variable in the estimation procedure.²

Against a background of the constraint represented by the relatively small dimension of the sample, and the ensuing low degrees of freedom available for estimation purposes, we start again with a very simple specification, which ties the changes in the external position of BIS reporting

¹ In the consolidated banking statistics, creditor data are reported on a nationality (i.e. home country) rather than a residence (i.e. host country) basis; moreover, reporting banks net out intergroup positions and consolidate positions across offices worldwide.

² About 80% of the external positions consist of standard cross-border loans from banks in country i to the banking and the non-banking sectors in country j , with the remainder including some other types of capital flows such as holdings by banks in country i of bonds, money market instruments and equities issued by the banking and the non-banking sectors in country j .

banks to a set of domestic pull factors describing the main features of the receiving economy. More precisely, we posit that cross-border banking flows are positively determined by: i) the real GDP growth rate of the receiving economy, since faster growing economies may have greater demand for credit, also from abroad (Cerutti *et al*, 2014; Bruno and Shin, 2015); ii) a measure of interest rate conditions, since countries characterized by higher interest rates will attract more capital from abroad *ceteris paribus* (Hoffmann and Mihaljek, 2010; Cerutti *et al*, 2014; Bruno and Shin, 2015); iii) a measure of exchange rate conditions, since appreciating local currencies will translate into stronger positions for debtor sectors borrowing in foreign currency, as is the case for CESEE economies (Hoffmann and Mihaljek, 2010; Bruno and Shin, 2015); iv) the annual growth rate in money supply, since cross-border banking flows have clear domestic monetary implications (Bruno and Shin, 2015).³ According to these indications, our initial empirical representation assumes the following form:

$$BANK_{i,t} = \alpha_i + \beta_1 G_i + \beta_2 R_i + \beta_3 NEER_i + \beta_4 M2_i + \epsilon_{i,t}$$

Our core results are again based on an unbalanced, quarterly panel data set covering the 11 economies in the CESE European region over the period 2008Q1-2015Q4. To reduce endogeneity concerns, all independent variables are again lagged by one quarter except the VIX, which is assumed to be exogenous so that current (log) values are used in the regressions. For the dependent variable, we use the exchange rate adjusted changes in the external exposure of BIS reporting banks vis-à-vis both the banking and non-banking sectors in CESEE economies reported in the BIS locational banking statistics: the four-quarter sum of cross-border banking inflows is divided by the four-quarter sum of domestic GDP at current prices to control for seasonality. As regards the measure of interest rate conditions, we again use the 3-month interbank rates since they are more widely available for the countries in our sample; moreover, nominal rather than real interest rates are preferred because banks make all the expected profit and loss calculations when granting loans in terms of the nominal interest rate. As regards the measure of exchange rate conditions, our choice has fallen on the nominal effective exchange rate for different types of reasoning. First of all, we are taking into account cross-border flows from *all* BIS reporting banks: if, on the one hand, it is logical to expect that euro area headquartered banks play the most important role within this club, on the other hand it is also true that they are not alone. This means that the use of a nominal FX rate vis-à-vis the euro alone would have not been the best choice. Moreover, we are not estimating a gravity model as in Hermann and Mihaljek (2010) which, on the contrary, would have justified the use of all the bilateral FX rates of the borrower country *j* with respect to the currencies of all its lender countries *i*.

In the first column, **Table B.1** shows , the estimation results of our basic model of cross-border banking inflows, confirming our expectations about both the sign and the statistical and economic significance of their coefficients. Cross-border banking flows are the larger the more robust the growth of real GDP and the M2 aggregate, the stronger the appreciation of the domestic currency

³ The logic behind this choice should read as follows. On the one hand, as put forward by Hermann and Mihaljek (2010), although the dependent variable is already adjusted for exchange rate changes, the adjustment in the published series may not control fully for the valuation effect. On the other hand, as in Bruno and Shin (2015), local borrowers – typically non-financial corporates – may have currency mismatches (to hedge exports, for instance); they could therefore borrow in U.S. dollars and then place the local currency proceeds into the domestic banking system as corporate deposits, which are a component of M2.

and the higher the level of domestic interest rates (although this variable turns out not to be not statistically significant).

We add different variables to this very basic representation aimed at capturing other important aspects that may affect the phenomenon being studied.

First of all, one may argue that cross-border bank flows respond to various risk characteristics of the borrower country, which are typically captured by indicators of external and domestic vulnerability: as regards the former, we add the current account balance-to-GDP ratio, expecting a higher deficit to reduce foreign bank inflows as it signals that domestic absorption is higher than domestic saving and therefore that the borrowing country may face external sustainability problems in the longer run; as regards the latter, we consider the government balance-to-GDP ratio, with a higher fiscal deficit expected to be positively correlated with the probability of default on government debt and hence negatively correlated with inflows of cross-border bank loans. Again, as shown by the results contained in the second column, both risk characteristics of the borrower country come in with the expected negative sign, although only the current account balance-to-GDP ratio ends up being statistically significant.

Another characteristic of the borrower country that may affect the flow of cross-border loans is the health of its domestic banking system. We measure bank health by two alternative proxies: the first one is the deviation of the banking industry sub-index from the main equity price index (Hermann and Mihaljek, 2010); the second is the commercial banks' net income to yearly averaged total assets, i.e. the return on assets (Bruno and Shin, 2015). A positive coefficient is expected for both indicators, as a banking sector under stress – e.g. one characterized by a large stock of non-performing loans in the home market negatively affecting its profitability – should normally attract lower cross-border bank inflows. The results in column 3 and 4 confirm this hypothesis: both the coefficients show an expected positive sign and turn out to be statistically significant.

There is a final set of measures regarding important institutional characteristics that might also affect a country's ability to borrow from abroad. An initial question may focus, for instance, on the relationship between cross-border banking flows and the stringency and efficacy of a country's banking sector regulatory system. To tackle this issue we use an indicator published by the World Economic Forum in its Global Competitiveness Report, the objective of which is to measure the existence of an appropriate and adequate regulation to protect investors and other actors in the economy at large. Second, one may argue whether a higher degree of financial integration into global markets, i.e. a lower number of restrictions on the free movement of capital, translates into larger cross-border banking flows. We try to take this feature into account properly by using a de facto degree of financial openness again, calculated as the ratio between the sum of assets and liabilities from the international investment position and domestic GDP. Finally, it would be logical to expect international banks to expand their businesses in countries characterized by more developed financial systems. Again, we resort to a set of variables comprising the indicator of financial market development published by the World Economic Forum in its annual Global Competitiveness Report, the ratio of the stock of credit to the private sector to GDP and the ratio of stock market capitalization to GDP.

The results of this battery of regressions are shown in columns 5-9, and conform to our initial expectations. In particular, it seems to be confirmed that the presence of a more stringent banking regulation and the use of capital flow management tools may reduce the borrower country's exposure to unexpected variations in international banking flows (Cerutti *et al*, 2014): the coefficients on both the legal rights index and the degree of capital account openness are as

expected, although only the former comes in as being statistically significant. In their absence, countries characterized by more developed and deeper financial systems will capitulate to receive larger cross-border banking flows, with both the positive and negative consequences that might follow.

As put forward by a large number of papers (for example, Hoffmann and Mihaljek, 2010; Bruno and Shin, 2012, 2013, 2014 and 2015; Forbes and Warnock, 2012; Miranda-Agrippino and Rey 2012; Rey, 2013; Cerutti *et al*, 2014; Rey, 2015), the main determinants of cross-border bank flows are variables determined on a global scale. From this point of view, the conclusions contained in Rey (2013) are illuminating. There appears to be a particularly strong commonality between international credit and portfolio (particularly debt) movements: both forms of capital flows should follow a global financial cycle which, in turn, is highly synchronized with fluctuations in world market risk aversion and uncertainty, traditionally proxied by the VIX index. This conclusion has been reinforced by that suggested by Bruno and Shin (2015), according to which the VIX negatively co-moves the U.S. broker dealer leverage, the most significant variable in their model of international cross-border banking. This conclusion is clearly verified for CESEE economies as well, as demonstrated by the results contained in Column (10).

Table B.1 The *banking liquidity* channel: basic model and role of local and global factors

CATEGORY	NAME OF VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Constant	1.893 (4.449)	-4.845 (0.996)***	-36.366 (17.806)**	-8.939 (2.054)***	3.582 (5.599)	6.102 (10.720)	-26.433 (20.103)	12.559 (4.050)**	-10.847 (1.524)***	7.841 (3.887)*
Domestic											
	Real GDP growth	0.551 (0.145)***	0.410 (0.108)**	0.460 (0.176)***	0.650 (0.139)***	0.583 (0.130)***	0.542 (0.188)**	0.523 (0.140)***	0.338 (0.144)**	0.443 (0.124)**	0.583 (0.153)***
	Short-term interest rate	0.200 (0.373)	-0.067 (0.134)	0.153 (0.487)	0.601 (0.271)*	0.792 (0.263)**	0.258 (0.366)	-0.020 (0.418)	0.510 (0.218)**	0.776 (0.259)**	0.309 (0.415)
	Exchange rate	0.241 (0.073)***	0.291 (0.053)***	0.198 (0.101)**	0.246 (0.084)**	0.277 (0.045)***	0.316 (0.086)***	0.248 (0.077)**	0.263 (0.059)***	0.059 (0.057)	0.209 (0.071)***
	M2 annual growth	0.177 (0.047)***	0.163 (0.019)***	0.157 (0.069)**	0.259 (0.125)*	0.151 (0.071)*	0.177 (0.045)***	0.195 (0.065)**	0.121 (0.030)***	0.201 (0.061)**	0.170 (0.057)***
Borrower vulnerabilities											
	Current account to GDP		-0.610 (0.207)**								
	Government balance to GDP		-0.097 (0.205)								
Banking sector health											
	Deviation of sector subindex			8.393 (4.012)**							
	Return on assets				3.616 (0.965)***						
Institutional characteristics											
	Strength of banking sector regulation					-1.352 (0.808)*					
	De facto degree of financial openness						0.022 (0.034)				
	Financial market development							6.911 (5.129)*			
	Credit to GDP								-0.345 (0.085)**		
	Stock market capitalization to GDP									0.212 (0.054)***	
Global											
	VIX										-2.089 (1.016)*
	Observations	230	209	198	163	230	229	230	230	198	237
	R-squared (adj.)	0.56	0.60	0.64	0.49	0.54	0.57	0.59	0.58	0.62	0.55

Note: the sample of 11 EMEs includes Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Hungary, FYR of Macedonia, Montenegro, Poland, Romania and Serbia. Robust standard errors are provided in parenthesis, ***p<0.01, **p<0.05, *p<0.1.

Appendix C. Description of variables

CATEGORY	NAME	DESCRIPTION	SOURCE	
Dependent variables	Portfolio flows	Portfolio investment flows by mutual funds specialised in emerging economies, as a percentage of nominal GDP.	EPFR	
	Banking flows	Exchange rate adjusted changes in external exposure of BIS reporting banks vis-à-vis both the banking and the non-banking sector, as a percentage of nominal GDP.	BIS locational banking statistics	
Independent variables (main)	Growth Domestic real GDP growth	Gross domestic product at constant prices, percentage change over 1 year	Datastream, Eurostat	
	Euro area real GDP growth	Gross domestic product at constant prices, percentage change over 1 year	Datastream, Eurostat	
	GDP growth differential	Real GDP growth differential between country <i>i</i> and the euro area, in percentage points.	Authors' calculations	
	Short-term interest rates	Domestic interbank rate	3-month interbank rate, in percent.	Datastream, national sources
		Euro area interbank rate	3-month Euribor rate, in percent.	Datastream, ECB
		Interbank rate differential	3-month interbank rate differential between country <i>i</i> and the euro area, in basis points	Authors' calculations
	Domestic policy rate	Monetary policy reference rates, in percent.	Datastream, national sources	
	Euro area policy rate	Interest rate on the main refinancing operations of the Eurosystem, in percent.	Datastream, ECB	
	Policy rate differential	Monetary policy reference rate differential between country <i>i</i> and the euro area, in basis points	Authors' calculations	
	M2 growth	M2 aggregate, percentage change over 1 year	Datastream, national sources	
	Exchange rate	Nominal effective exchange rate, percentage change over 1 quarter.	BIS	
	VIX	The Chicago Board Options Exchange Volatility Index, calculated as a weighted average of the implied volatilities of eight put and call options written on S&P 500 index.	Datastream	
	Financial and liquidity measures	Growth of euro area credit	M2 aggregate, percentage change over 1 year	Datastream, ECB
		Growth of euro area M2	Credit to the private sector, percentage change over 1 year	Datastream, ECB
		Long-term bond yields	Yield on the 10-year AAA euro area sovereign bonds, in percent.	Datastream, ECB
		Slope of the yield curve	Difference between 10-year and 3-month AAA euro area sovereign bonds, in basis points.	Authors' calculations
		Fragmentation/Redenomination risk	Difference between Italian and Spanish 10-year sovereign bond yields and the respective German Bund, in basis points.	Datastream
Announcement		Indicator dummy equalling 1 in all the quarters listed in Table 1.	Authors' calculations	
Independent variables (other)	Credit to GDP	Nominal credit to the private sector as a percentage of nominal GDP	IMF-IFS, national sources	
	Current account to GDP	Current account balance as a percentage of nominal GDP	IMF-IFS, national sources	
	De facto degree of financial openness	Sum of assets and liabilities from international investment position, as a percentage of nominal GDP.	National sources	
	Deviation of banking sector subindex	Deviation of banking sector subindex from the overall stock market index, in percent.	Datastream	
	Financial market development	Index	World Economic Forum	
	Government balance to GDP	Government balance as a percentage of nominal GDP	Eurostat, national sources	
	Reserves to M2	Foreign exchange reserves (excluding gold) as a percentage of M2	Datastream, national sources	
	Return on assets	Commercial banks' net income to yearly averaged total assets.	IMF-FSI; national sources	
	Short-term external debt to reserves	Short-term external debt is proxied by the sum of liabilities to BIS reporting banks and international bonds outstanding by residence of issuers, both with a maturity of less than one year. The short-term external debt is then reported as a percentage of foreign exchange reserves	JEDH; IMF-IFS	
	Stock market capitalization to GDP	Stock market capitalization as a percentage of nominal GDP	Bloomberg	
Strength of banking sector regulation	Legal rights index, 0–10 (best)	World Economic Forum		